REMARKS

In response to the Office Action dated August 5, 2002, claims 1-3 and 10 have been canceled and claims 4-6 and 11-12 have been amended. Claims 4-9 and 11-21 are now in the case. Reexamination and reconsideration of the application, as amended, is requested.

The Examiner rejected claims 1-2, 7, 11 and 12 under 35 U.S.C. § 102(e) as being anticipated by Tajika et al. (U.S. Patent No. 6,089,697). Next, claims 3 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tajika et al. in view of Fujimori (U.S. Patent 6,338,542). However, the Examiner stated that **claims 13-21** were allowable as they stand and that **claims 4-5 and 8-10** were allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims.

Although the Applicants contend that the claims are allowable before the present amendment, in an effort to expedite the prosecution of this case, the Applicants have canceled claims 1-3 and 10 and have amended **allowable** claims 4-5 to include all of the limitations of the respective base claims. In addition, claims 6 and 11-12 have been amended to include the limitations of the allowable claims. Therefore the above-mentioned rejections under U.S.C. § 102(b) and U.S.C. § 103(a) are moot.

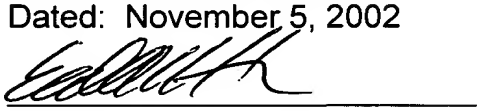
With regard to the dependent claims, because they depend from the above-argued respective independent claims, and they contain additional limitations that are patentably distinguishable over the cited references, these claims are also considered to be patentable [(MPEP § 2143.03)]. As such, pending **claims 4-9 and 11-21** are also **patentable**.

In view of the above, the Applicants respectfully submit that the claims of the subject application are in immediate condition for allowance. The Examiner is respectfully requested to withdraw the outstanding claims rejections and to pass this application to issue. Additionally, in an effort to expedite and further the prosecution of the subject application, the Applicants kindly invite the Examiner to telephone the Applicants' attorney at (818) 885-1575 if the Examiner has any

questions or concerns. Please note that all correspondence should continue to be directed to:

Hewlett Packard Company
Intellectual Property Administration
P.O. Box 272400
Fort Collins, CO 80527-2400

Respectfully submitted,
Dated: November 5, 2002



Edmond A. DeFrank
Reg. No. 37,814
Attorney for Applicants

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE TITLE

Below is a marked-up version of the amended Title:

[HIGH-PERFORMANCE, HIGH-DENSITY INK JET PRINTHEAD HAVING MULTIPLE MODES OF OPERATION] FLUID EJECTION DEVICE WITH STAGGERED INK DROP GENERATORS

IN THE SPECIFICATION

Below are marked-up versions of the amended specification:

For the "FIELD OF THE INVENTION" on page 1, the first full paragraph:

[The present invention relates in general to thermal ink jet (TIJ) printheads and more specifically to a system and method for high-performance printing having multiple modes of operation that uses a monochrome ink jet printhead having a staggered, high-density arrangement of ink drop generators.] The present invention relates to a fluid ejection device with staggered ink drop generators.

For the "SUMMARY OF THE INVENTION" from the second full paragraph on page 3 to the last full paragraph on page 5 (the entire summary):

[To overcome the limitations in the prior art as described above, and to overcome other limitations that will become apparent upon reading and understanding the present specification, the present invention is embodied in a monochrome ink jet printhead capable of multiple modes of operation that includes a high density of ink drop generators to provide high-resolution one-pass printing. In particular, the present invention can perform one-pass printing at a paper axis print resolution of greater than double the resolution of a single row. The present invention addresses at least one of the problems associated with a high-density array of ink drop generators and nozzles and provides high-quality one-pass printing having a high print resolution. In addition, the present invention allows for printing in multiple print modes depending on the desired print speed, print resolution and print quality.

The high-performance monochrome ink jet printhead of the present invention includes a high-density staggered arrangement of ink drop generators disposed on a printhead structure. Each ink drop generator is a thin-film structure formed in the

printhead structure that is fluidically coupled to an ink supply device and has a nozzle. Ink is supplied to the ink drop generator and at the appropriate time heated and ejected from the associated nozzle. The high-density staggered ink drop generator arrangement includes a plurality of ink drop generators arranged along each of at least three axes. The three axes are substantially parallel and are spaced apart from each other. The plurality of ink drop generators along a single axis is staggered with respect to the pluralities of ink drop generators along the other axes. Each plurality of ink drop generators along a single axis has an axis pitch, and staggering provides an effective pitch of the combined axes that is a fraction of the axis pitch. In a preferred embodiment, each plurality of ink drop generators along an axis has an axis pitch of approximately $1/300^{th}$ of an inch, thus giving the printhead of the present invention with a preferred arrangement of four pluralities of ink drop generators along four axes an effective pitch of approximately $1/1200^{th}$ of an inch. This decrease in effective pitch (and consequent increase in print resolution) means that fewer scans are needed to provide a desired print resolution resulting in high-resolution printing at high speed.

The high-density arrangement of ink drop generators used in the present invention can be subject to manufacturing artifacts that can impact the print quality. Specifically, the manufacturing process used to form the nozzles may cause a change in ink drop trajectories. The present invention overcomes this decrease in print quality by allowing operation in a plurality of print modes, depending on the desired print resolution, speed and quality. The present invention also includes a method of high-performance printing in a plurality of print modes using the ink jet printhead of the present invention.

Other aspects and advantages of the present invention as well as a more complete understanding thereof will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention. Moreover, it is intended that the scope of the invention be limited by the claims and not by the preceding summary or the following detailed description.]

The present invention includes as one embodiment a fluid ejection device coupled to an ink supply and having multiple printing modes, including a sufficient

number of ink drop generators fluidically coupled to the ink supply device and formed in the fluid ejection device and arranged along at least three axes that are substantially parallel and spaced apart from each other to provide printing resolution of at least 600 dots per inch with each printing mode. The plurality of ink drop generators is arranged along four axes that are substantially parallel and spaced transverse to each other and wherein the plurality of ink drop generators arranged along the four axes are staggered with respect to each of the axes to decrease an effective pitch of the fluid ejection device to approximately one-fourth that of a plurality of ink drop generators arranged along a single axis.

IN THE ABSTRACT

[A monochrome ink jet printhead having a high-density array of ink drop generators capable of multi-mode operation. The printhead of the present invention includes the array of ink drop generators arranged in at least three groups of nozzles with each group staggered relative to each other. This staggered arrangement provides high print resolution at high speed. In addition, the multiple modes of operation provided by the present invention permits different print modes depending on the desired print speed, resolution and quality. In a preferred embodiment, the present invention is capable of printing in a one-pass 1200 dpi mode at high speed, a two-pass 600 dpi mode high print quality and a one-pass 600 dpi mode at high speed. The present invention also includes a method of high-performance printing using the ink jet printhead of the present invention.]

The present invention includes as one embodiment a fluid ejection device coupled to an ink supply and having multiple printing modes, including a sufficient number of ink drop generators fluidically coupled to the ink supply device and formed in the fluid ejection device and arranged along at least three axes that are substantially parallel and spaced apart from each other to provide printing resolution of at least 600 dots per inch with each printing mode. The plurality of ink drop generators is arranged along four axes that are substantially parallel and spaced transverse to each other and wherein the plurality of ink drop generators arranged along the four axes are staggered with respect to each of the axes to decrease an

effective pitch of the fluid ejection device to approximately one-fourth that of a plurality of ink drop generators arranged along a single axis.

IN THE CLAIMS

Below are marked-up versions of amended claims 4-6 and 11-12:

4. (Twice Amended) The fluid ejection device of claim [3,] 5, wherein the plurality of ink drop generators arranged along the at least three axes are staggered with respect to each of the axes to decrease an effective pitch of the fluid ejection device and wherein the effective pitch of the fluid ejection device is decreased to less than half that of a plurality of ink drop generators arranged along a single axis.

5. (Twice Amended) [The fluid ejection device of claim 2,] A fluid ejection device coupled to an ink supply and having multiple printing modes, comprising:

a sufficient number of ink drop generators fluidically coupled to the ink supply device and formed in the fluid ejection device and arranged along at least three axes that are substantially parallel and spaced apart from each other to provide printing resolution of at least 600 dots per inch with each printing mode;

wherein the plurality of ink drop generators is arranged along four axes that are substantially parallel and spaced transverse to each other;

wherein the plurality of ink drop generators arranged along the four axes are staggered with respect to each of the axes to decrease an effective pitch of the fluid ejection device to approximately one-fourth that of a plurality of ink drop generators arranged along a single axis.

6. (Twice Amended) [The fluid ejection device of claim 1,] A fluid ejection device coupled to an ink supply and having multiple printing modes, comprising:

a sufficient number of ink drop generators fluidically coupled to the ink supply device and formed in the fluid ejection device and arranged along at least three axes that are substantially parallel and spaced apart from each other to provide printing resolution of at least 600 dots per inch with each printing mode;

wherein at least some of the plurality of ink drop generators are arranged along two of the at least three axes in a staggered manner so as to approximately double a print resolution with respect to a plurality of ink drop generators arranged along a single axis;

wherein an arrangement of ink drop generators along each of the three axes is an axis group having an axis pitch of approximately 1/300 of an inch and whereby a combination of two staggered adjacent axis groups have an effective pitch of approximately 1/600 of an inch.

11. (Twice Amended) The fluid ejection device of claim [1] 5, wherein the fluid ejection device is a disposable print cartridge.

12. (Twice Amended) The fluid ejection device of claim [1] 5, further comprising:

a carriage assembly for imparting relative motion between the fluid ejection device and a print media;

an ink supply device fluidically coupled to the plurality of ink drop generators; and

a controller for controlling operation of the carriage assembly.